

2.0 Traffic and Accident Data

2.1 Traffic Analysis

2.1.1 Source of Data

Average Daily Traffic (ADT) volumes were obtained by use of mechanical tube counters during the week of December 6-12, 1999 at three mainline locations, and on all interchange ramps in the I-17 corridor from SR 101L to Black Canyon City. The volume information is contained in the report entitled "Technical Memorandum No. 1 for I-17 Mainline Corridor Study", June 1, 2000.

Year 2025 traffic assignments are contained in the report prepared for this study entitled *I-17 Widening Study, SR 101L TI to Black Canyon City TI, Traffic Forecast Report*, October 2000. The forecasts and methodology is further discussed in the next section.

2.1.2 Traffic Data

Existing (1999) Conditions

In the *Traffic Forecast Report*, October 2000, the December 1999 ADT's were converted to Average Annual Daily Traffic (AADT) for three mainline locations. These AADT's are presented in Table 9 below.

TABLE 9 – AVERAGE ANNUAL DAILY TRAFFIC – 1999

Location	AADT
Under SR 101L	72,300
South of Carefree Highway	55,300
South of Black Canyon City TI	30,400

Hourly distribution of traffic for the three locations shown in Table 9 is summarized below.

Weekday – The peak hour was between 3 and 4 PM at all three locations. The percent of traffic ("K") occurring during the peak hour varied with 7% at Black Canyon City TI, 7.8% at Carefree Highway TI, and 7.5% at SR 101L. The directional split ("D") varied from 51-49, 55-45 and 52-48 with the southbound being the heavier volume.

Saturday – Peak hour was also from 3 to 4 PM, with a "K" of 7.7%. The "D" was 59-41 with southbound the heaviest volume.

For 20 to 30 weekends per year, rural/recreation traffic cause congestion on weekends. Rural/recreational traffic traveling to the north on I-17 on Friday afternoons and returning southbound into the Phoenix area on Sunday afternoons has grown at a 5% growth rate over the last 20 years. These rural/recreational peak hours are the design hourly volumes at the north end of the corridor. At the south end of the corridor, Maricopa Association of Governments' (MAG) prediction of Monday through Friday workdays utilizes urban AM and PM peak hours as the design conditions.

2025 Traffic Assignment

When the October 2000 *Traffic Forecast Report* was prepared, forecasts for the Design Year 2025 were not available from MAG. However, projections for the Years 2020 and 2040 using MAG and the North Valley Partnership (NVP) data were available. The NVP is a group of public and private sector stakeholders formed to evaluate the impacts of growth in the north I-17 corridor. The MAG adopted and NVP alternative population and employment projections were reviewed. After this review, and comparison of MAG and NVP traffic forecasts on I-17, traffic forecasts for the Year 2025 were prepared that represented the higher growth scenario of either the MAG or the NVP population and employment projections. The assignment results for daily and PM peak hour traffic volumes are shown on Figures 5 and 6, respectively.

2.1.3 Traffic Operational Analysis

Existing (1999) Conditions

A July 12, 2000, report prepared for this study entitled *Technical Memorandum No. 2 for I-17 Mainline Corridor Study From SR 101L to Black Canyon City TI* examined the existing traffic operations. The capacity analyses of existing conditions at three locations on the I-17 mainline were conducted using the procedures from the Highway Capacity Manual (HCM). Basic freeway operation is characterized by traffic volumes, speeds and density. Density is the primary parameter to measure performance of a freeway and it is expressed as level of service (LOS) from A to F. The mainline capacity analyses were conducted using the basic freeway module of the HCM software and the density ranges shown in the HCM for each level of service.

A summary of the I-17 mainline levels of service is shown in Table 10.

TABLE 10 – SUMMARY OF I-17 MAINLINE LEVEL OF SERVICE (DECEMBER 1999 VOLUMES)

Analysis Types	Locations		Level of Service	
			AM	PM
Basic Freeway	I-17 at SR101L	NB	D	C
		SB	C	C
	I-17 South of Carefree Highway	NB	B	B
		SB	B	C
	I-17 South of Black Canyon City TI	NB	B	B
		SB	B	B
Ramp Merging	From SR101L EB to I-17 NB		E	D

The basic freeway section assumed no traffic influence of turbulence caused by the adjacent ramp merge and diverge area on the mainline. Overall, the studied freeway sections are operating at a LOS C and better, with the exception of the northbound I-17 mainline, which is operating at a LOS D at SR 101L during the AM peak hour.

2025 Capacity Analysis

A capacity evaluation for year 2025 was included in the *Traffic Forecast Report*, October 2000. Based upon data received from ADOT, truck or "T" factors of 9% south of Anthem Way and 19% to the north were used for the analysis.

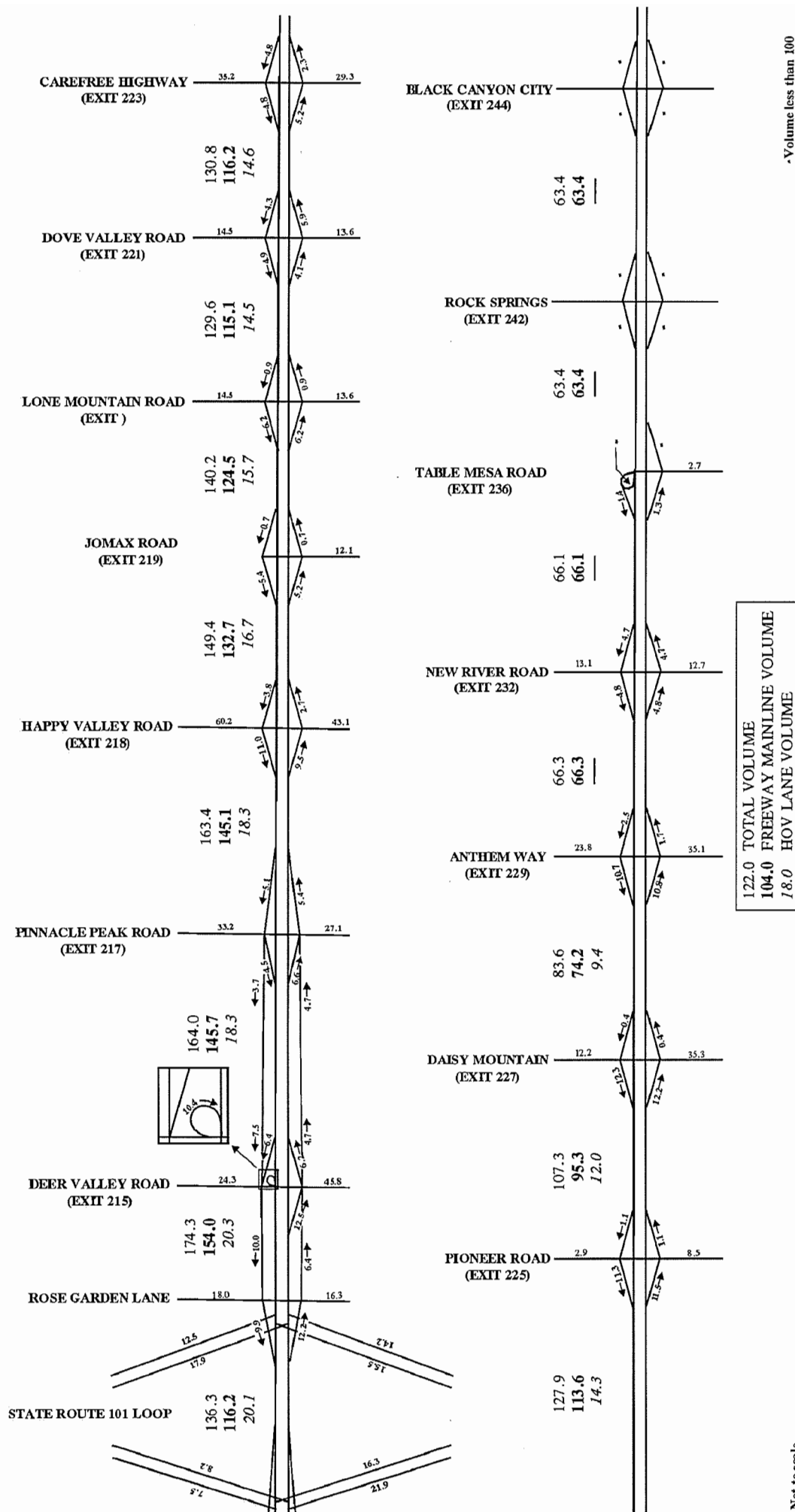


FIGURE 5 – 2025 TRAFFIC FORECAST

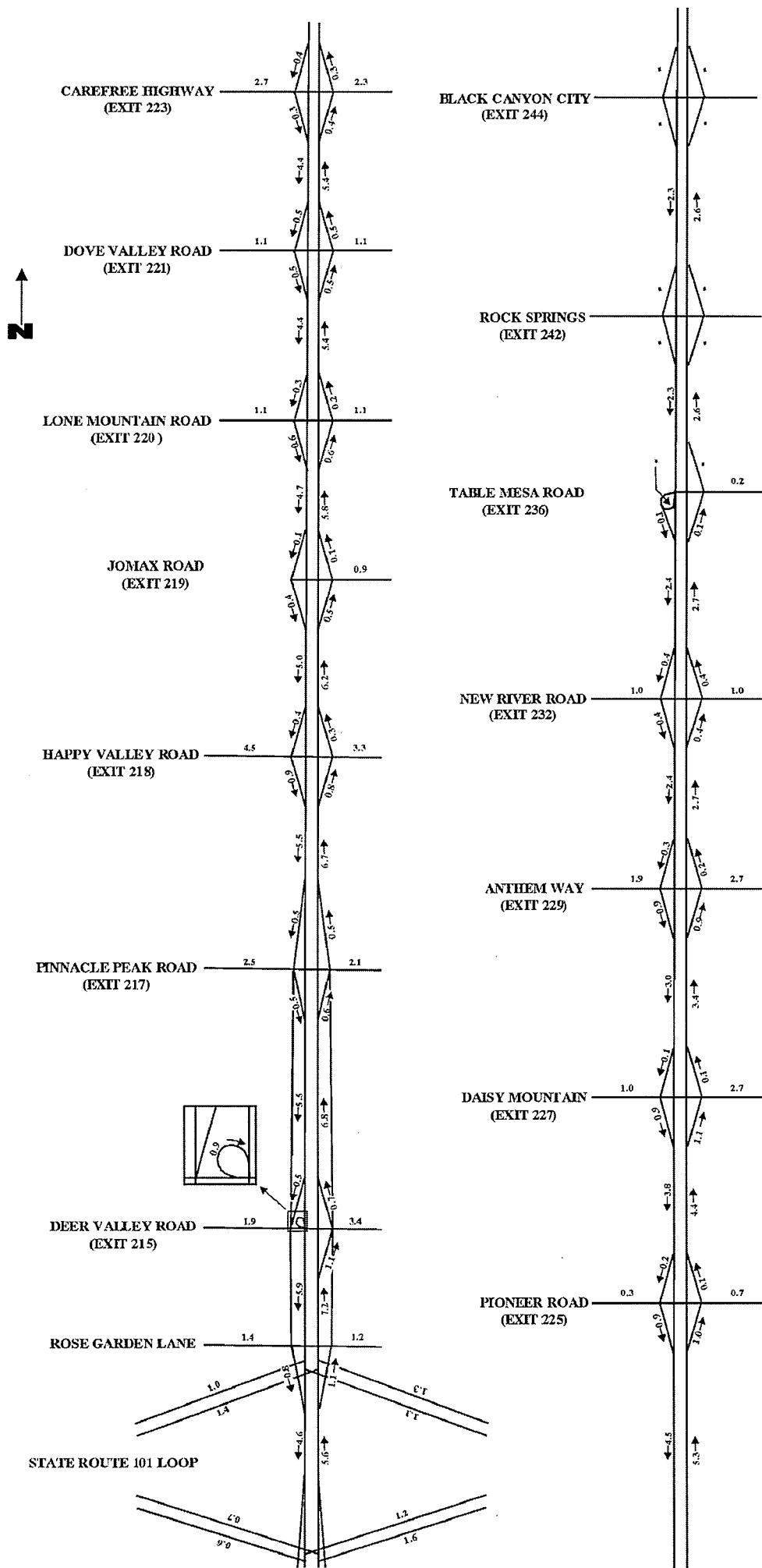


FIGURE 6 – 2025 TRAFFIC FORECAST, PM PEAK HOUR

Chapter 3 of the Third Edition of the *Highway Capacity Manual* (HCM), updated December 1997, specifies that the maximum service flow rate for a freeway lane is 2,400 passenger cars per hour per lane (pcphpl) for a freeway operating at 70 or 75 mph. For I-17, an adjustment needed to be made to the maximum service flow rate due to the effect of heavy vehicles.

For conditions north of the Anthem Way TI, the maximum flow rate was multiplied by 0.91 to account for the 19 percent truck volume. South of Anthem Way, the 9 percent truck factor is 0.96. The resultant maximum service flow rates for various freeway widths (in one direction of travel) are as shown in Table 11.

TABLE 11 – MAXIMUM DIRECTIONAL SERVICE FLOW RATES
(Assuming 2,400 pcphpl under ideal conditions)

	2-Lanes	3-Lanes	4-Lanes	5-Lanes
North of Anthem Way (Truck Factor = 0.91)	4,368	6,552	8,736	10,920
South of Anthem Way (Truck Factor = 0.96)	4,608	6,912	9,216	11,520

For 2025 peak hour urban conditions, the volume to capacity (V/C) ratios and LOS were calculated for each segment of roadway from SR 101L to Black Canyon City assuming a four, six, eight or ten-lane freeway (in two directions of travel). The results showed that LOS C could be achieved for an urban condition with four to eight-lane sections (in two directions of travel) throughout the corridor.

Another analysis approach was conducted by assuming that I-17 will only be urbanized as far north as Anthem Way, and then evaluating the balance of the corridor as a rural, recreational weekend section. The capacity analysis for the section of freeway north of Anthem Way used data from ADOT's automatic traffic recorders on I-17 to arrive at a 30th highest hour. This approach showed that the 30th highest hour is 15 percent of the average daily traffic volume. For a weekend recreational condition, LOS C can be achieved from Anthem Way to Black Canyon City with an eight-lane section.

The recommended number of lanes required to achieve LOS C is ten (five in each direction of travel) plus HOV from SR 101L to Carefree Highway (SR 74), eight (four in each direction of travel) plus HOV from Carefree Highway to the New River TI, and eight (four in each direction of travel) from the New River TI to Black Canyon City. Carefree Highway was selected as the northern limit of the 5+1 section because it represents the "worst case" location of the future Loop 303.

Northbound Deer Valley Exit Ramp Analysis

The northbound weave from SR 101L and I-17 to Deer Valley Road was analyzed in the technical memorandum *Weave Analysis, NB I-17, SR 101 On Ramp to NB I-17, Deer Valley Off Ramp*, March 2003.

The existing geometrics for northbound I-17 provide two through lanes and an auxiliary lane between the northbound SR 101L on ramp and the northbound Deer Valley Road off ramp. This configuration provides acceptable level of service (LOS D) during current PM and off-peak hour traffic periods, but breaks down (LOS E) during the current AM peak hour traffic period. The existing geometrics will operate at level of service F for all future volume conditions.

The proposed geometrics provide three through lanes on I-17, which are joined by two lanes from SR 101L. The existing northbound Deer Valley Road off ramp departs from mainline northbound I-17 on the right side approximately 2060 feet north of the I-17 northbound and SR 101L merge. Northbound I-17 continues as a five-lane freeway section north of the Deer Valley Road exit ramp.

This configuration provides good level of service (LOS B) during current AM, PM, and off peak hour traffic periods. However, the proposed geometrics will provide poor level of service (LOS E) for 2025 MAG PM peak hour and LOS F for 2025 North Valley Forum (NVF) AM peak hour traffic volumes. The proposed geometrics will provide acceptable level of service (LOS C) during 2025 NVF off peak traffic periods. The year 2025 NVF PM peak hour traffic volumes exceed the capacity of the proposed basic freeway segment. The proposed geometrics break down from LOS D to LOS E for the PM peak hour traffic volumes after year 2012 (NVF).

Diverting northbound I-17 traffic exiting to Deer Valley Road through Rose Garden Lane exit could slightly reduce the difficulty this traffic will have in weaving two lanes to the Deer Valley Road off ramp. This diversion would allow the proposed geometrics to operate at acceptable level of service (LOS D) for 2025 MAG PM peak hour traffic volumes, poor level of service (LOS E) for 2025 NVF AM peak hour traffic volumes and acceptable level of service (LOS C) for 2025 NVF off peak hour traffic volumes. The proposed configuration, with the diversion, breaks down from LOS D to LOS E for the PM peak hour traffic volumes after year 2013 (NVF), providing only one additional year of acceptable LOS.

An alternate to the proposed geometrics would close the existing northbound I-17 off ramp to Deer Valley Road and construct a new loop off ramp to the north of the Deer Valley Road crossroad. The loop ramp would have a minimum of 1000 feet of deceleration on I-17 and a 25-mph design speed. The terminus of the ramp would be on the north leg of the signalized intersection of Deer Valley Road and the northbound frontage road. The length between the gore point of SR 101L entrance ramp and the gore point of the Deer Valley loop off ramp would be 3,340 feet.

The loop ramp alternate changes an overloaded weave condition to an acceptable merge and diverge condition. The alternate operates at acceptable level of service (LOS C) for 2025 MAG PM peak hour and 2025 NVF AM peak hour traffic volumes and good level of service (LOS B) for 2025 NVF off peak hour traffic volumes.

Capacity Analysis for the I-17/Union Hills TI

A capacity analysis was prepared for the I-17/Union Hills TI in the Technical Memorandum *Capacity Analyses for the I-17 & Union Hills Traffic Interchange, Evaluation of the Proposed Geometric Change to Eliminate the SB "By-pass" Ramp Over Union Hills Drive*, March 2003. This analysis addresses lane drop and taper lengths for the added southbound mainline lane and the ramps from SR 101L. The added SR 101L directional ramp lanes are currently tapered out over a short distance.

The existing Union Hills TI geometrics provide a diamond interchange with a southbound frontage road bypass lane running parallel to I-17 over the Union Hills Drive cross road bridge. Current traffic volumes were used to analyze AM and PM peak hour operations.

An alternative to the existing layout consists of eliminating the bypass lane, diverting this traffic through the Union Hills TI, and constructing a southbound right-turn lane to westbound Union Hills Drive.

The analysis indicates that the existing Union Hills Drive TI operates at good levels of service (LOS C) for the current AM and PM peak hours. The analysis also indicates that the TI can provide good to acceptable levels of service (LOS C to D) for the AM and PM peak hours with the removal of the southbound bypass lane and the addition of a southbound right-turn lane.

2.2 Crash Analysis

2.2.1 Source of Data

The source of data for this section is the ADOT Traffic Studies Branch motor vehicle crash records database. The available crash data at the time of the study was through March 2000.

2.2.2 Crash Data

A July 12, 2000, report entitled *Technical Memorandum No. 2 For I-17 Mainline Corridor Study From SR 101L to Black Canyon City TI* examined crash data.

Crash data from the ADOT database was obtained for the I-17 mainline between the SR 101L and Black Canyon City TI, a distance of 30.3 miles. The time period covered by the data is from January 1, 1997 through March 31, 2000. The I-17 mainline types of crashes are shown in Table 12.

TABLE 12 – I-17 MAINLINE MOTOR VEHICLE COLLISION TYPES

Collision / Year	1997	1998	1999	2000 ¹	Total
Overturning	39	32	29	10	110
Collision with other MV	106	126	188	21	441
Collision with Pedestrian	5		2		7
Collision with MV other Roadway	1		1		2
Animal	7	3	6	1	17
Fixed Object	78	82	72	22	254
Object in Roadway	1	1	1		3
Other			1		1
Miscellaneous	37	54	88	7	186
Total	274	298	388	61	1021

¹ Three months of data from January to March.

Table 13 provides data for the manner of crash.

TABLE 13 – I-17 MAINLINE MOTOR VEHICLE COLLISION MANNER

Collision / Year	1997	1998	1999	2000 ¹	Total
Single Vehicle	158	167	183	35	543
Sideswipe (same-dir)	26	35	41	6	108
Sideswipe (opposite-dir)			2		2
Angle	1				1
Rear-End	67	77	126	13	283
Head-On	2		1		3
Other	16	17	34	6	73
Non-Contact	4	2	1	1	8
Total	274	298	388	61	1021

¹ Three months of data from January to March.

A summary of crash severity is shown in Table 14.

TABLE 14 – CRASH SEVERITY SUMMARY

Year / Type	No-injury	Injury	Fatal	Total
1997	177	89	8	274
1998	201	90	7	298
1999	268	118	2	388
2000 ¹	35	24	2	61
Total	681	321	19	1021

¹ Three months of data from January to March.